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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/831,508	05/10/2001	Nobuki Matsui	819-540	5656
7590 11/17/2004			EXAMINER	
Nixon Peabody 8180 Greensboro Drive Suite 800 McLean, VA 22102			DUONG, THANH P	
			ART UNIT	PAPER NUMBER
			1764	

DATE MAILED: 11/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/831,508

Applicant(s)

MATSUI ET AL.

Examiner

Tom P Duong

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 August 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

Applicants' remarks and amendments filed on August 26, 2004 have been carefully considered. Claims 1 and 10 have been amended. Claims 1-17 are pending in this application.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 1-5 are rejected under 35 U.S.C. 102(b) as being anticipated by PCT/NO099/00280 (PCT '280). Regarding claim 1, PCT '280 discloses a hydrogen gas generator (Fig. 2) for generating hydrogen from a family, oxygen, and steam, source fuel of the hydrocarbon (via line 1) said hydrogen gas generator comprising a fuel reformer (ATR) with a catalyst (page 17, claim 13) which exhibits an activity to a partial oxidation reaction of said source fuel; wherein said source fuel, oxygen, and steam are supplied to said reformer (ATR) so that said partial oxidation reaction (POx) occurs on said catalyst and a water gas shift reaction (shift reactor) occurs in which CO (page 5, lines 12) produced in said partial oxidation reaction is a reactant. With respect to the water gas reaction occurs in the fuel reformer, PCT '280 discloses the gas mixture from the fuel reformer reactor contains mainly the gas components CO, H₂, H₂O, and CO₂ and some CH₄ (page 6, lines 22-25 and page 5, lines 9-13). Being the fact that the

CO₂ is one of the product components of the fuel reformer, the water gas shift reaction inherently takes place in the fuel reformer to a certain degree based on the operating condition of the reformer. Regarding claim 2, PCT '280 shows on Tables 2 and 3 the water gas shift reaction is controlled such that the CO₂/CO ratio, which is the ratio of CO₂ to CO in an outlet gas of said fuel reformer (5), is not less than 0.2. Regarding claim 3, PCT '280 discloses the supply rate of source fuel and steam to said fuel reformer is set such that the H₂O/C ratio (S/C), which is the ratio of the number of moles of said steam to the number of moles of carbon of said source fuel, is not less than 0.5 (Tables 2 and 3). Regarding claim 4, PCT '280 discloses the hydrogen gas generator with H₂O/C ratio of not more than 3 (page 6, lines 18-19). Regarding claim 5, PCT '280 discloses the hydrogen gas generator with outlet gas temperature of said fuel reformer (ATR) is not more than 800 degrees centigrade (page 2, lines 7-8).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 6-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over PCT '280 in view of Lahn et al. (5,160,456). Regarding claims 6 and 8, PCT '280 discloses the O₂/C theoretical mixture ratio is set to 0.6 but fails to disclose the ratio of the number of moles of said oxygen to the number of moles of carbon of said source

fuel less than 0.9 times the O₂/C theoretical mixture ratio in said partial oxidation reaction, and the O₂/C ratio is not more than 1.5 times O₂/C theoretical mixture ratio. Lahn '456 teaches the oxygen and alkane feed molar ratio is about 0.2 to 1.0 and the O₂ is added to provide the sensible heat for reactants and to maintain the overall reaction temperature at a desired level in the reaction zone (Col. 6, lines 3-15). Thus, it would have been obvious in view of Lahn to one having ordinary skill in the art to control the amount of oxygen to fuel ratio to obtain and/or maintain the desired operating temperature in the reaction zone. Regarding claim 7, Lahn teaches the O₂/alkane feed ratio is 0.2 to 1.0 and the O₂/CH₄ is 0.5 to 1.0 in the POx {CH₄ + 1/2O₂ = CO + 2H₂}. In order to complete the conversion of methane gas to synthesis gas in the POx, it is obvious in view of Lahn that PCT '280 has a ratio of the number of moles of oxygen to the number of moles of carbon of said source fuel greater than said O₂/C theoretical mixture ratio in the POx. Claim 9 recites limitations similar to claims 6 and 3, above; thus, claim 9 is rejected for the same reasons as applied to claims 6 and 3. Regarding claim 10, PCT '280 discloses a hydrogen gas generator (Fig. 2) for generating hydrogen from a source fuel of the hydrocarbon family, oxygen, and steam, said hydrogen (via line 1) gas generator comprising: a fuel reformer (ATR) with a catalyst (page 17, claim 13) which exhibits an activity to a partial oxidation reaction (Pox) of said source fuel, and the H₂O/C ratio (S/C), which is the ratio of the number of moles of said steam to the number of said source fuel carbon moles, is not less than 0.5 but not more than 3 (Tables 2 and 3) whereby said partial oxidation reaction occurs on said catalyst and a water gas shift reaction (shift reactor) occurs in which CO produced in said partial

oxidation reaction is a reactant; wherein said water gas shift reaction controlled such that the CO₂/CO ratio, which is the ratio of CO₂ to CO in an outlet gas of said fuel reformer (ATR), is not less than 0.2 (Tables 2 and 3) and wherein the temperature of said outlet gas (5) of said fuel reformer (ATR) is not more than 800° C (page 2, lines 7-8). PCT '280 discloses the O₂/C theoretical mixture ratio is set to 0.6 but fails to disclose the ratio of the number of moles of said oxygen to the number of moles of carbon of said source fuel less than 0.9 times but not more than 1.5 times the O₂/C theoretical mixture ratio in said partial oxidation reaction. Lahn '456 teaches the oxygen and alkane feed molar ratio is about 0.2 to 1.0 and the O₂ is added to provide the sensible heat for reactants and to maintain the overall reaction temperature at a desired level in the reaction zone (Col. 6, lines 3-15). Thus, it would have been obvious in view of Lahn to one having ordinary skill in the art to control and/or optimize the amount of oxygen to fuel ratio to obtain and/or maintain the desired operating temperature in the reaction zone. Regarding claim 11, PCT '280 fails to disclose active site catalyst is formed of at least one of rhodium and ruthenium. Lahn '456 teaches the use of catalysts selected from Group VII and VIII (Col. 4, lines 26-31) including rhodium and ruthenium to facilitate the conversion of methane gas to synthesis gas (Col. 4, lines 62-65). Thus, it would have been obvious in view of Lahn to one having ordinary skill in the art to modify the device of PCT '280 with the catalyst as taught by Lahn in order to facilitate the conversion of methane gas to synthesis gas.

3. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over

prior art as applied in claim 11 and further in view Madgavkar et al. (4,186,801). The prior art fails to disclose the catalyst is supported on a honeycomb monolith carrier.

Madgavkar teaches oxidation catalyst is carried on by an inert support structure such as a honeycomb monolith carrier and such structure provides the benefits of supporting the catalyst and minimizes the pressure drop across the bed (Col. 5, lines 35-54). Thus, it would have been obvious in view of Madgavkar to one having ordinary skill in the art to modify the hydrogen gas generator of prior art with a catalyst of honeycomb monolith carrier as taught by Madgavkar in order to gain the above benefits.

4. Claims 13-14 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over prior art as applied in claims 1-12, above and further in view of Negishi (6,165,633). The fuel cell system is being treated as an apparatus. Regarding claim 13, PCT '280 fails to disclose a fuel cell capable of generating electricity by making use of hydrogen fuel. Negishi teaches the fuel cell 40 (Fig. 1) is capable of converting chemical energy to electrical energy (Col. 1, lines 19-22). Thus, it would have been obvious in view of Negishi to one having ordinary skill in the art to modify the device of the prior art with a fuel cell system as taught by Negishi in order to convert chemical energy to electrical energy. Regarding claim 14, PCT '280 fails to disclose a discharged gas supply means (35) for supplying a steam-containing gas, discharged from an oxygen electrode of said fuel cell, to said fuel reformer (5) for a supply of steam to said fuel reformer (5). Negishi teaches the oxidizing exhaust gas (via 73) from the oxygen electrode is recycled to the air tank 36 then to a reformer 22 to maximize the utilization of the fuel (Col. 15 lines 4-5). Thus, it would have been obvious in view of Negishi to

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one having ordinary skill in the art to modify the hydrogen gas generator of PCT '280 with oxidizing exhaust gas stream 73 as taught by Negishi in order to maximize the utilization of the fuel. Regarding claim 17, PCT '280 fails to disclose air supply means for supplying air to fuel cell. Negishi teaches air supply means (via line 77) to the fuel cell to facilitate the oxidation reaction in the fuel cell (Col. 17, lines 17-21). Thus, it would have been obvious in view of Negishi to one having ordinary skill in the art to modify the device of PCT '280 with air supply means as taught by Negishi in order to facilitate the oxidation reaction in the fuel cell.

5. Claims 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over prior art as applied in claim 13, and further in view of Harashima (5,290,641).

Regarding claim 15, the prior art fails to disclose output current control means (38) for controlling the output current said fuel cell so that the oxygen concentration and the steam concentration of a discharged gas that is supplied to said fuel reformer (5) fall within their respective given ranges. Harashima teaches the control system 5, which measures the output current from the power inverter system 4 and compares the output current with the reference point, and then sends the correct current signal to adjust the flow rate of G1, G2, G3, and A to minimize the load fluctuation (Col. 1, lines 53-67 and Col. 2, lines 1-30). Thus, it would have been obvious in view of Harashima to one having ordinary skill in the art to modify the device of prior art with control means as taught by Harashima in order to minimize load fluctuation in the fuel cell power supply. Regarding claim 16, the prior art fails to disclose the output current control means for controlling the output current of said fuel cell so that the coefficient of utilization of

oxygen of said fuel cell ranges from 0.4 to 0.75. Harashima teaches the control system 5 with sensor to detect output current from power inverting system 4 and compares the output current with the reference current, and then adjusts the oxygen (air flow rate A) to the fuel cell (Col. 1, lines 53-67 and Col. 2, lines 1-30). Such output current control means provides the benefit of minimizing load fluctuation in the fuel cell power supply. Thus, it would have been obvious in view of Harashima to one having ordinary skill in the art to modify the device of prior art with output current control means as taught by Harashima to minimize load fluctuation in the fuel cell power supply. Although, the prior art fails to disclose the coefficient of oxygen of fuel cell ranges from 0.4 to 0.75; however, the prior art in view of Harashima appears to provide a control system that optimizes the utilization of oxygen in the fuel cell and it would have been obvious to obtain such coefficient values thru fine tuning of the control elements. Also, adjusting the output current control means to obtain an optimum operating conditions would have been considered a result effective variable by one having ordinary skill in the art at the time the invention was made (See *In re Boesch*, 617 F.2d.272,205 USPQ 215 (CCPA 1980)) and (See *In re Aller*, 105 USPQ 223).

Response to Arguments

Applicant's arguments filed 8/26/04 have been fully considered but they are not persuasive.

Examiner respectfully disagrees with respect to the argument of the shift reaction in PCT '280 does not occur in the fuel reformer (ATR), but rather in a shift reactor. PCT '280 discloses the gas mixture from the fuel reformer reactor contains mainly the gas components CO, H₂, H₂O, and **CO₂** and some CH₄ (page 6, lines 22-25 and page 5, lines 9-13). Being the fact that the **CO₂** is one of the product components of the fuel reformer, the water gas shift reaction inherently takes place in the fuel reformer to a certain degree based on the operating condition of the reformer.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (CO₂/CO ratio of the claimed invention is 0.45-0.56) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

With respect to CO₂/CO ratio of 0.2 or more, Examiner agrees that the conversion rate for CO₂/CO in Table 2 of PCT '280 is less than 0.2 (ratio of CO₂/CO is 4/30 at 1200° C) for a given S/C = 0.5. However, the conversion rate for CO₂/CO for S/C=0.5 at 800°F is not less than 0.2 (CO₂/CO is 19.4/11.7).

With respect to the operating temperature of the reformer not more than 800 ° C, PCT '280 disclose an operating temperature at 800°C which anticipates at a point.

Applicant also argued that the teaching of Lahn is different from the claimed invention and cannot be combined with PCT '280. Examiner respectfully disagrees since Lahn's reference clearly illustrates the chemical reactions (Col. 1, lines 26-50) of the reforming of natural gas similar to the chemical reactions of PCT '280. However, PCT '280 is silent with respect to the O₂/C ratio. Lahn '456 teaches the oxygen and alkane feed molar ratio is about 0.2 to 1.0 and the O₂ is added to provide the sensible heat for reactants and to maintain the overall reaction temperature at a desired level in the reaction zone (Col. 6, lines 3-15). Thus, it would have been obvious in view of Lahn to one having ordinary skill in the art to control and/or optimize the amount of oxygen to fuel ratio to obtain and/or maintain the desired operating temperature in the reaction zone.

With respect to the active site of a catalyst formed of Rh or Ru, Lahn clearly teaches the use of catalysts selected from Group VII and VIII (Col. 4, lines 26-31) including rhodium and ruthenium to facilitate the conversion of methane gas to synthesis gas (Col. 4, lines 62-65). Thus, it would have been obvious in view of Lahn to one having ordinary skill in the art to modify the device of PCT '280 with the catalyst as taught by Lahn in order to facilitate the conversion of methane gas to synthesis gas.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tom P Duong whose telephone number is (571) 272-2794. The examiner can normally be reached on 8:00AM - 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on (571) 272-1444. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Tom Duong
November 12, 2004

TD



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